

amendments and the following remarks a reconsideration and allowance of the application is requested.

Applicants respectfully traverse the rejection of claims based on the cited prior art references. As the following discussion indicates, the prior art does not disclose or suggest the claimed invention.

Sarvazyan 5,678,565 discloses a system which employs an ultrasonic transducer and an attached pressure sensing array. The description is not clear, but it appears that the ultrasonic transducer emits ultrasound and images the reflected echo signals. At the same time, it appears the pressure sensing array measures the strain pattern on the surface of the tissue. There is no indication that the ultrasound is produced as a beam which is modulated in amplitude at a "modulation frequency" as recited in claim 1. Nor is there any indication of a detector for receiving a sonic wave produced at the modulation frequency as recited in claim 1.

Bowen 4,385,634 discloses a system in which a pulse of radiation is used to cause a rapid, but small temperature rise in tissues (col. 3, lines 62 - col. 4, line 8). The temperature rise produces a thermoacoustic wave which is detected by an acoustic pressure or acoustic wave detector (col. 4, lines 29-39). There is no suggestion that an ultrasonic beam be modulated at a "modulation frequency", or that a detector receives a sonic wave produced at the modulation frequency as recited in claim 1 of the present application.

Parker et al 5,099,848 discloses a system in which tissues are oscillated by a low frequency vibration source and at the same time imaged with a pulsed ultrasound imaging system. The vibration source is described at column 6, lines 56-58.

"It should be understood that the vibration source 100 may be sound or any type of electromagnetic radiation which causes the object under investigation to vibrate."

There is no suggestion in this reference that an ultrasonic beam be modulated in amplitude at a modulation frequency and that a detector for receiving a sonic wave at the modulation frequency be employed.

Sato et al. 4,566,460 discloses a system for measuring characteristics of an acoustic medium in which two sonic waves are used. One is referred to as "pumping

wave" and is a series of ultrasonic pulses, and the other is referred to as a "probing beam". The probing beam is an ultrasonic beam which shifts in phase when the pumping wave is turned on. The amount of phase shift indicates a characteristic of the acoustic medium.

This reference does not disclose producing an ultrasonic beam modulated in amplitude at a modulation frequency and using a detector for receiving a sonic wave at the modulation frequency as recited in claim 1.

Shimura et al. 4,610,255 discloses a system that is virtually the same as that described in the Sato et al patent. The main difference is that the probing beam is generated in bursts, rather than continuously.

Sarvazyan 5,606,971 discloses a system for detecting the viscoelastic properties of a media by measuring the speed and attenuation of shear waves produced by a focused ultrasonic beam. The detector employed in the present invention as recited in claim 1 receives a sonic wave produced at a modulation frequency. Sarvazyan does not disclose such a detector. The "means for detecting" recited in pending claim 5 senses the motion of an object that is a target of the modulated sonic beam. Sarvazyan does not disclose such a detector.

While all of the references disclose methods for producing waves or beams of energy to acquire information from within an object, none of them disclose the method and apparatus of the present invention as recited in the pending claims. The claims are believed to recite patentable subject matter and allowance of the same is requested.

Respectfully submitted,

JAMES F. GREENLEAF, ET AL.

Dated: November 20, 1998

By:


Barry E. Sammons
Reg. No. 25,608
Attorney for Applicant
QUARLES & BRADY, LLP
411 East Wisconsin Avenue
Milwaukee WI 53202
(414) 277-5705